



# Facts about Forced-Air Warming

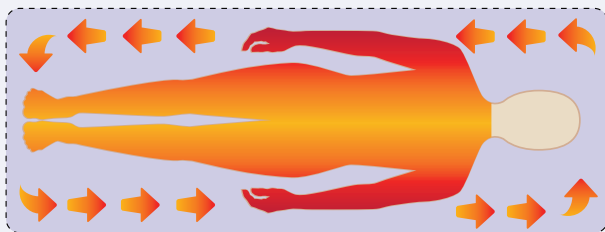
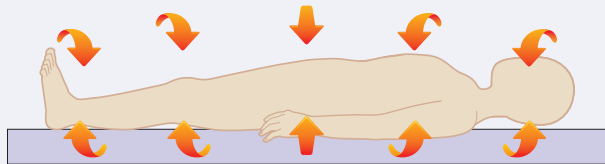
# Convective vs Conductive

## Patient Warming Systems

Convective warming systems and conductive warming systems warm patients in very different ways.

### Convective Warming

Convective warming is the transmission of heat from a forced-air warming blanket to the patient by circulating warm air around the patient's body.



Front

Heated Area

#### Heat Transfer

- Warms a greater percentage of body surface area compared with conductive methods<sup>1</sup>
- Air-to-surface warming
- Blanket design ensures the warm-air circulated around the patient's body is optimised

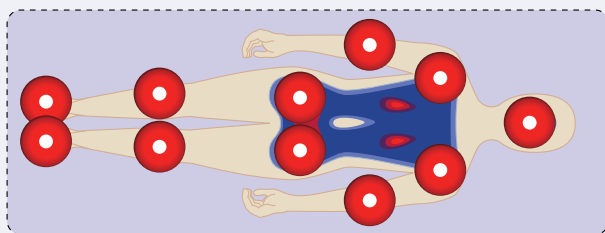
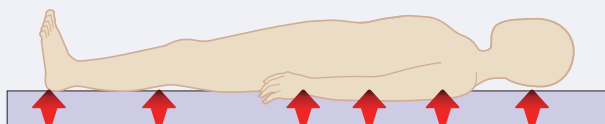
#### Methods

- Overbody forced-air warming blankets
- Underbody forced-air warming blankets
- 3M Forced-air warming gown

A flexible range of products providing effective warming solutions for virtually any surgical procedure and patient

### Conductive Warming

Conductive warming is the transmission of heat from the heating source (mattress) through direct patient contact.



Back

Heated Area

#### Heat Transfer

- Warms the patient only where contact is made between the skin and the warming device

#### Methods

- Gel pads
- Conductive table pads
- Electric pads
- Water mattresses and blankets

Warming capability could be limited due to patient positioning and required surgical access. e.g. Lithotomy/lateral positions

# Convective

## Patient Safety

- Convective systems transfer heat by circulating warm-air around the patient's body
- Pressure points are not warmed. The blanket compresses where the patient makes contact, preventing heat transfer
- Fluid outlets on the underbody blanket range help to keep the patient dry and minimise the cooling effect of excess fluids and the potential for skin maceration

## Convenience

- Single-patient use
- Simple storage
- Versatile, can be used preoperatively, intraoperatively and during recovery, in speciality suites, A&E, trauma and on hospital wards

# Conductive

## Patient Safety

- Conductive systems transfer heat by direct patient contact (pressure points)
- Pressure points may become ischemic due to impaired circulation. Therefore, thermal injury can occur as a result of ischemia and contact with the heating source
- The potential for fluids to pool on the surface of the mattress increasing the possible risk of cooling the patient and causing skin maceration

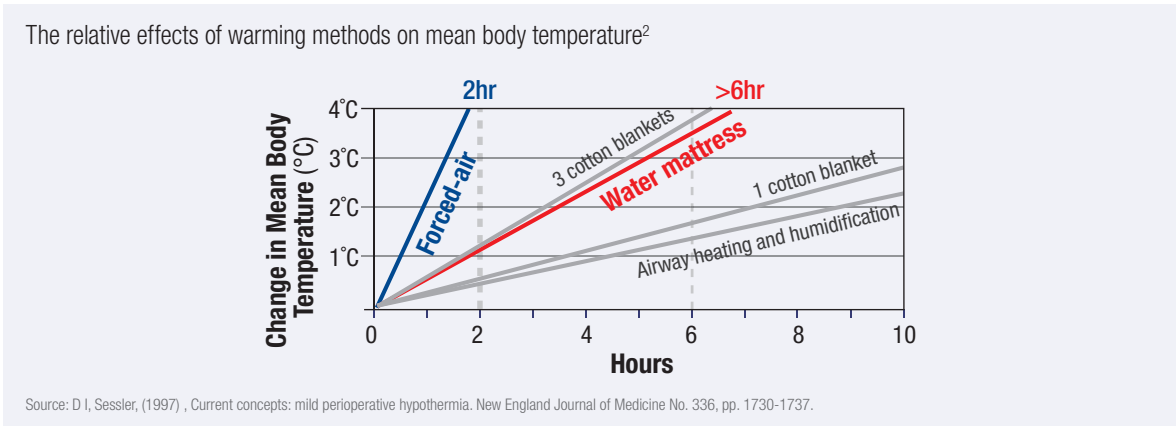
## Convenience

- Needs to be cleaned between procedures
- Some conductive warming devices can be subject to damage if stored incorrectly
- Primarily used intraoperatively

# Facts about Convective vs Conductive Warming Systems

More than 100 scientific studies have been written about the benefits of forced-air warming and the prevention of hypothermia. Studies have shown forced-air warming to be the most effective warming method, in general, for preventing and treating inadvertent perioperative hypothermia.<sup>1,2,3,4,5,6,7</sup>

Conductive warming can take 2-3 times longer than forced-air warming. See graph below:

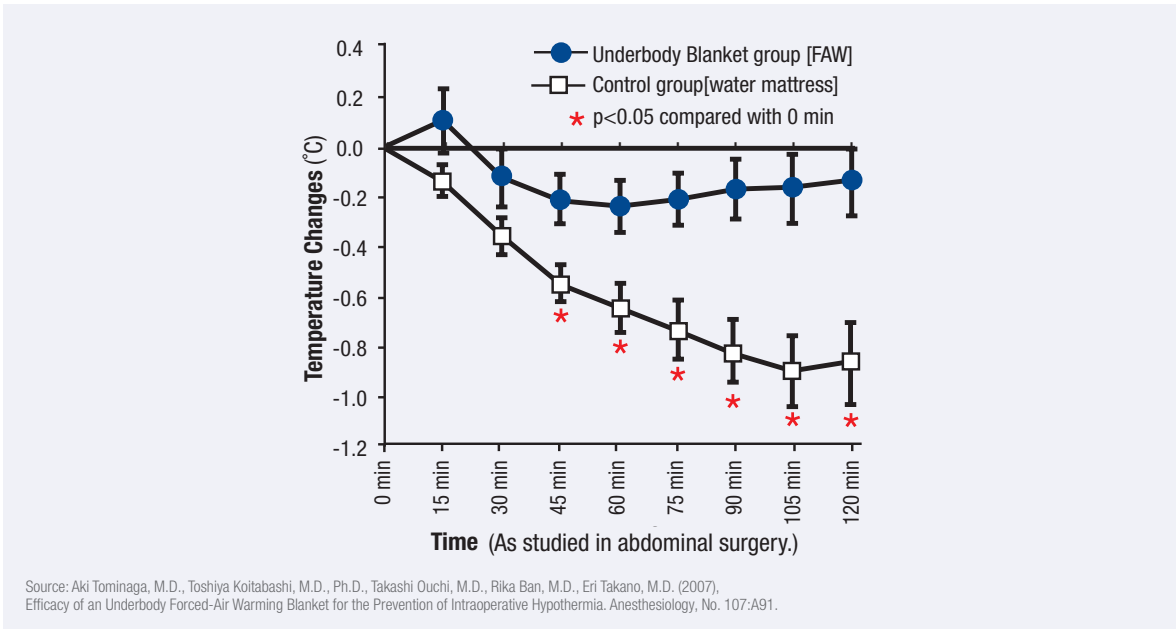


## Forced-Air Warming - Using an Underbody Warming Blanket

A study by Aki Tominaga et al found that forced-air warming using an underbody blanket:

- May prevent the initial temperature decrease caused by redistribution temperature drop<sup>4</sup>
- Was more effective at preventing hypothermia during abdominal surgery compared with water mattresses<sup>4</sup>
- Recruits greater body surface area and is more effective in preventing hypothermia during abdominal surgery than an upper body blanket<sup>4</sup>

## Changes in oesophageal temperature<sup>4</sup>



# Facts about Forced-Air Warming

Safe, effective forced-air warming

Find out more about forced-air warming’s proven track record of safety and efficacy in preventing hypothermia.



Forced-air warming is the gold standard of care for managing perioperative normothermia in operating rooms throughout the world.<sup>1,8-12</sup>

During the past 25 years, more than 165 million patients worldwide have been warmed perioperatively using 3M™ Bair Hugger™ Therapy Forced-Air Warming. In that time, there has never been a report of a surgical site infection linked to Bair Hugger therapy use.<sup>13</sup>

Forced-air warming has been studied extensively. There are over 100 published papers documenting its clinical benefits.

Published research papers have shown that the use of forced-air warming does not increase either the risk of wound infection or bacterial contamination of the operating theatre.<sup>14,15</sup> In fact, when tested during actual surgical conditions, research has shown that forced-air warming actually decreases the bacterial count at the surgical site.<sup>15</sup>

Normothermia is an important tool in the fight against surgical site infections (SSIs).<sup>14,15,16</sup> Healthcare quality initiatives, including guidelines from the National Institute for Clinical Excellence (NICE), the National Health Service (NHS) Saving Lives programme, the 1,000 Lives Campaign in Wales and Scotland’s Patient Safety Programme all note the importance of normothermia maintenance in SSI reduction. Several of these organisations specifically mention forced-air warming as a key means of maintaining normothermia.


3M™ Bair Hugger™ Therapy Blankets are single patient use, therefore, they can reduce the potential for cross-contamination between patients when compared with reusable devices.

Forced-air warming blankets are designed to produce local, short-range increases in airflow velocity. Flow visualisation techniques demonstrate that the airflow from Bair Hugger blankets has no significant effect on operating theatre airflow.<sup>17,18</sup>

A study published by Anesthesia & Analgesia<sup>19</sup> shows that forced-air warming systems do not impair operating theatre air quality, with or without laminar flow ventilation. The use of the Bair Hugger blankets caused no statistically significant difference in particle counts, regardless of whether the forced-air warming unit was set to off, ambient air or high heat setting. Neither the forced-air warming blanket nor the forced-air blower generated upward air that interfered with the normal unidirectional stream of the laminar air flow system.<sup>19</sup>

25 years  
23 blankets  
over 165 million  
patients warmed





# Ten important reasons to Warm Every Surgical Patient

## one

### Redistribution Temperature Drop (RTD)

All surgical patients, regardless of age, weight or other factors, undergoing general or regional anaesthesia are susceptible to Redistribution Temperature Drop (RTD). Research shows that core body temperature drops up to 1.6°C in the first hour following the induction of general anaesthesia,<sup>2</sup> increasing the risk of inadvertent perioperative hypothermia and its associated complications, which include higher mortality rates,<sup>21</sup> longer hospital stays<sup>22</sup> and an increased rate of wound infection.<sup>20</sup>

## two

### Prevention through Prewarming

Stop inadvertent perioperative hypothermia before it begins by prewarming your patients with 3M™ Bair Hugger™ Blankets or the 3M™ Bair Paw™ Patient Adjustable Warming System. Prewarming patients for as little as 10 to 20 minutes prior to general anaesthesia adds to the total heat content of your patient's body, helping to prevent perioperative hypothermia and reduce postoperative shivering.<sup>23</sup>

## three

### Surgical Site Infection (SSIs) Reduction

The National Institute for Clinical Excellence (NICE) clinical guideline 65 and the Scottish Patient Safety Alliance note the importance of maintaining normothermia to help reduce the incidence of surgical site infections in surgical patients. Both initiatives also recommend the use of forced-air warming as an active warming measure to maintain normothermia.

## four

### Cost-Effective

When comparing the cost of the 3M™ Bair Paws™ and 3M™ Bair Hugger™ Systems with the estimated £3154 per patient cost<sup>24,25</sup> of treating complications of inadvertent perioperative hypothermia (NICE clinical guideline 65, 2008), warming every surgical patient just makes sense.

## five

### NICE Clinical Guideline 65

In April 2008, NICE released guidelines for the prevention of inadvertent perioperative hypothermia, describing it as a condition that can increase the risk of wound infection and other complications, and prolong post-anaesthetic recovery. The guidelines include forced-air warming of any patient:

- undergoing a procedure of 30 minutes or longer
- with a preoperative temperature of <36 °C, or
- whose operation, though less than 30 minutes, puts them at high risk of hypothermia or its complications



## six

### Improving Outcomes

In surgery, maintaining normothermia has been shown to decrease wound infection, length of stay, and mortality rates.<sup>26</sup>

## seven

### Proven Technology

Since forced-air warming was introduced over 25 years ago, it has been used to safely and effectively maintain patient normothermia in over 165 million patients worldwide.<sup>13</sup> This technology has been studied extensively, with more than 100 published studies documenting the clinical benefits of forced-air warming and maintaining normothermia.

## eight

### Preferred Method of Warming Patients

Forced-air warming is used in the majority of UK hospitals and its presence is growing worldwide.<sup>27</sup>

## nine

### A Warm Patient = A Happy Patient

The 3M™ Bair Paws™ Patient Adjustable Warming System uses forced-air warming to make patients feel cosy and comfortable, and research shows that forced-air warming can reduce surgical patient anxiety. Bair Paws gowns also fully cover your patients, offering modesty at a time when many feel vulnerable.<sup>28</sup>

## ten

### A Cold Patient = An Unhappy Patient

Of all the feelings a patient experiences, being cold before and after surgery is the one many remember most. With the current focus and increasing interest on patient satisfaction, why leave a chilly impression? A survey of 1,844 surgical patients in the USA who used the Bair Paws warming gown found 83% of respondents preferred the Bair Paws gown over the standard hospital gown<sup>28</sup> and more than 77% said they would tell a friend or family member about their experience.<sup>28</sup> Nearly 86% said the Bair Paws gown kept them comfortable before surgery.<sup>28</sup>

Visit [www.bairhugger.co.uk](http://www.bairhugger.co.uk) for more information about forced-air warming.



## E-Learning

E-Learning courses are available to health care professionals who would like to learn more about patient warming. Log in and register at [www.3m.co.uk/elearning](http://www.3m.co.uk/elearning) for access.

## References:

1. Brauer, A., et al (2004), Conductive Heat Exchange with a Gel-Coated Circulating Water Mattress. *Anaesthesia and Analgesia*, Vol. 6, No. 99, pp. 1742-1746
2. Sessler, D.I., (1997), Current Concepts: mild perioperative hypothermia, *New England Journal of Medicine*, No. 336, pp. 1730-1737.
3. Karlinski, R. et. al. Intraoperative Warming with vitalHEAT during Open Abdominal Surgery. *ASA abstracts*, 2010. A086. \* vitalHEAT is a trademark of Dynatherm Medical, Inc..
4. Tominaga A, Koitabashi T, Ouchi T, Ban R, Takano E. Efficacy of an underbody forced-air warming blanket for the prevention of intraoperative hypothermia. *Anesthesiology*. Vol 1072007:A91.
5. Ouchi, T. et. al. Lithotomy Underbody Air Blanket Can Prevent Intraoperative Redistribution Hypothermia . *ASA abstracts*, 2010. A088.
6. Engelen, S, et al. (2010) A Comparison of Under-Body Forced Air and Resistive Heating during Hypothermic, on-pump cardiac surgery. *Anaesthesia*, Vol.66, No.2 , pp.104-110.
7. Roder, G. et al (2011), Intra-operative rewarming with Hot Dog(Registered symbol R in circle) resistive heating and forced-air heating: a trial of lower -body warming, *Anaesthesia*, Vol 66, No. 8, pp. 667-674.
8. Sessler DI, Moayeri A. (1990), Skin-surface warming: heat flux and central temperature. *Anesthesiology*, No.73, pp. 218-24.
9. Giesbrecht GG, Ducharme MB, McGuire JP. (1994), Comparison of forced-air patient warming systems for perioperative use. *Anesthesiology*, No.80, pp.671-9.
10. Hynson JM, Sessler DI. (1992), Intraoperative warming therapies: a comparison of three devices. *Journal of Clinical Anesthesia*, No. 4, pp. 194-9.
11. Kurz A, Kurz M, Poeschl G, Faryniak B, Redl G, Hackl W. (1993), Forced-air warming maintains intraoperative normothermia better than circulating-water mattresses. *Anesthesia Analgesia* , No. 77, pp. 89-95.
12. Borms SF, Engelen SL, Himpe DG, Suy MR, Theunissen WJ. (1994), Bair Hugger forced-air warming maintains normothermia more effectively than thermo-lite insulation. *Journal of Clinical Anesthesia*, No. 6, pp.303-7.
13. Data on file at 3M US, based on internal sales data from Arizant USA, a 3M company 2012.
14. Zink RS, Ializzo PA, (1993), Conductive warming therapy does not increase the risk of wound contamination in the operating room. *Anesthesia Analgesia*, No. 76, pp.50-3.
15. Huang JK, Shah EF, Vinodkumar N, Hegarty MA, Grotorex RA, (2003), The Bair Hugger patient warming system in prolonged vascular surgery: an infection risk? *Critical Care* No. 7, R13-R16
16. Kurz A., Sessler D.I., Lenhardt R.L. (1996) Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. *New England Journal of Medicine* No. 334, Vol. 19, pp. 1209-1215
17. Sharp RJ, et al. (2002), Do warming blankets increase bacterial counts in the operating field in a laminar-flow theatre? *Journal of Bone Joint Surgery Br*, No. 84, B:486-8.
18. Miyazaki H, Sato M, Okazaki K. (2007), Forced-air warmer did not increase the risk of contamination caused by interference of clean airflow. *Anesthesiology*, No. 107, A1594
19. Sessler DI, Olmsted RN, Kuelpmann R. Forced-air warming does not worsen air quality in laminar flow operating rooms. *Anesthesia & Analgesia*, No. 113, pp. 1416-21
20. Barie PS (2002), Surgical Site Infections: Epidemiology and Prevention. *Surgical Infections*. Vol. 3, S-9 – S-21.
21. Tryba M, Leban J, et al. (1996), Does active warming of severely injured trauma patients influence perioperative morbidity? *Anesthesiology*. No. 85, Vol. A283
22. Jeran L. (2001), American Society of PeriAnesthesia Nurses Development Panel. Clinical Guideline for the Prevention of Unplanned Perioperative Hypothermia. *Journal of PeriAnesthesia Nursing*. Vol. 16(5), pp. 305-314.
23. Horn, E.P, Bein, B et al (2012) The effects of short time periods of pre-operative warming in the prevention of peri-operative hypothermia. *Anaesthesia*, Vol. 67, pp.612-617
24. Plowman R, Craves N, Griffin M et al. (2000) The socio-economic burden of hospital acquired infection. London: Public Health Service, 1999.
25. National Institute of Clinical Excellence, Clinical Guideline 65, Inadvertent perioperative hypothermia, The management of inadvertent perioperative hypothermia in adults, April 2008.
26. Mahoney CB, Odom J. (1999), Maintaining intraoperative normothermia: A meta-analysis of outcomes with costs. *AANA Journal*. No. 67, pp. 155-163.
27. Data on file at 3M UK, based on internal sales data.
28. Arizant Healthcare Inc. Bair Paws Patient Satisfaction Study. 2006-2007.



**Infection Prevention Division**  
**3M Health Care Limited**  
 3M House, Morley Street  
 Loughborough  
 Leicestershire LE11 1EP  
 Tel: 01509 613371  
 Fax: 01509 237288  
 Email: [ip.uk@mmm.com](mailto:ip.uk@mmm.com)  
 Web: [www.3mhealthcare.co.uk](http://www.3mhealthcare.co.uk)

**3M Ireland**  
 The Iveagh Building  
 The Park  
 Carrickmines  
 Dublin 18  
 Tel: 00 353 (01) 280 3555  
 Fax: 00 353 (01) 280 3509  
[www.3M.ie](http://www.3M.ie)

3M is a trademark of 3M Company.  
 BAIR HUGGER, BAIR PAWS and the BAIR HUGGER and BAIR PAWS logo are trademarks of Arizant Healthcare Inc. A 3M Company.  
 Please recycle. Printed in England. © 3M 2013. All rights reserved.  
 IPD-PW-BH-6014-1-UK-0213 / PW007L